

8000 Peak discharge = 7290 cubic feet per second at 1:00 p.m. 7000 6000 5000 ○ 4000 3000 2000 1000 Sept. 15 Sept. 12 1982 TIME, IN HOURS

Figure 6.--Discharge hydrograph for Beaver Creek (site 1) at Huntingdon, Tenn. (see table 2 for site description).

Figure 1.--Report area showing selected discharge, water surface elevation, and rainfall accumulation data.

Intense rainfall on September 12-13, 1982, caused severe local flooding along many streams in Gibson County in western Tennessee. The rainfall resulted from remnants of Hurricane Chris combining with a cool front moving across the western half of Tennessee. The purpose of this report is to document these floods by showing the distribution and amounts of rainfall, and magnitude and frequency of flood discharges at several streamflow sites. These data can provide (I) a technical basis for making flood-plain management decisions that could minimize existing and future flood problems and (2) a basis for designing and constructing drainage structures along roadways. The report area includes Gibson County, and parts of Carroll and Madison Counties in western Tennessee (fig. 1). Streams where major flooding occurred include Rutherford Fork and South Fork Obion River, and North Fork and Middle Fork Forked Deer River.

INTRODUCTION

These streams are tributaries to the Opion River. COOPERATION AND ACKNOWLEDGMENT

This report was prepared in cooperation with the Tennessee Department of Transportation as part of a continuing flood investigation program with the U.S. Geological Survey. Acknowledgment is made to the Tennessee Department of Transportation for providing aerial photographs and for surveying reference points and high-water marks to National Geodetic Vertical Datum. Acknowledgment is made to Depart N. George (Discourse Cipson County Civil Defense) and local residents for providing Donald N. Goad (Director, Gibson County Civil Defense) and local residents for providing photographs and information on flood damage. Acknowledgment is also made to the National Weather Service at Memphis, Tenn., for providing raintall data.

ADDITIONAL DATA Additional information pertaining to floods on streams in the report area can be obtained from reports by Randolph and Gamble (1976), Robbins (1984), and from the District Office of the U.S. Geological Survey, A-413 Federal Building-U.S. Courthouse, Nashville, TN 37203. Black and white copies of this report can be purchased from: Open-File Services Section, Western Distribution Branch, U.S. Geological Survey, Box 25425, Federal Center, Denver, CO 80225 (Telephone: (303) 236-7476).

STORM KAINFALL

Rainfall data for the September 12-13, 1982 storm in Gibson County were collected by the National Weather Service. Their station at Humboldt (fig. I) recorded 12.0 inches of rainfall in 16 hours, 8.2 inches of that amount fell in the 4-hour period between 10:00 p.m. on September 12 and 200 a.m. on September 13 (fig. 2). In addition, rainfall data were collected by the U.S. Geological Survey at an urban hydrology rainfall-runoff gaging station on Middle Fork Forked Deer River Tributary at Humboldt (fig. 1, site 9). This station recorded 13.18 inches of rainfall in 14 hours; 7.6 inches of that amount fell in the 4-hour period between 10:00 p.m. on September 12 and 2:00 a.m. on September 13 (fig. 3). Table 1 shows (1) rainfall amounts for the 100-year frequency taken from U.S. Weather Bureau Technical Paper No. 40 (1961) and (2) the maximum September 12-13, 1982 storm Bureau Technical Paper No. 40 (1961) and (2) the maximum September 12-13, 1982 storm rainfall for various increments of time from both recording gages at Humboldt. Total rainfall accumulation data for various locations in the report area are shown on figure 1.

Table 1.--Summary of rainfall during the September 12-13, 1982 storm in Gibson County and 100-year rainfall frequency for selected time increments

Duration, in hours	100-year frequency	Rainfall, in inches National Weather Service station at Humboldt, Tenn.	USGS urban hydrology rainfall-runoff station at Humboldt, Tenn.
1	3.2	2.4	2.9
2	4.0	4.6	5.3
3	4.4	6.6	7-0
6	5.3	9.5	10.5
12	6.3	11.9	13.15
24	7.3	12.0	13.18

during the September 12-13, 1982 storm. Rainfall of 4.6 inches at the National Weather Service station and 5.3 inches at the U.S. Geological Survey station fell during the 2-hour period between 11:00 p.m. on September 12 and 1:00 a.m. on September 13. By contrast, rainfall for the entire month of September at Humboldt is normally about 4.0 inches. During the September 12-13, 1982 storm, the National Weather Service station at Milan (about 14 miles northeast of Humboldt) recorded 13.62 inches of rainfall; and local residents in Trenton (about 14 miles north of Humboldt) reported over 13 inches of rainfall

Rainfall of 2- to 24-hour duration at Humboldt exceeded the 100-year frequency

STORM RUNOFF Runoff from the September 12-13, 1982 storm resulted in record-breaking floods on many streams in the report area. Long-time residents in the three-county area reported

that stream stages during the September 12-13, 1982 flood were higher than any previous stages since at least 1922. According to the Trenton Herald Gazette, parts of practically all major roads in Gibson County were inundated by flood water.

Flood Frequency The relation of flood-peak magnitude to the probability of occurrence, or recurrence interval, is referred to as a flood-frequency relation. As applied to annual floods, recurrence interval is the average interval of time between exceedances of the indicated flood magnitude. For example, a flood with a 100-year recurrence interval may be expected to be equaled or exceeded on the average of once in 100 years or, stated another way, it is a flood that has a 1 in 100 chance of occurring in any given year. However, the fact that a flood of this magnitude occurs in any given year does not reduce the probability of a flood of equal or greater magnitude occurring within the same year, or in consecutive years. The 100-year flood discharge was exceeded at five of seven gaging stations and miscellaneous sites for which September 12-13, 1982 flood data are available (table 2, fig. 1).

The peak discharges and recurrence intervals for the flood at Beaver Creek at Huntingdon (site 1, table 2) and Middle Fork Forked Deer River Tributary at Humboldt (site 9, table 2) were derived by analyzing continuous streamflow records at the two stations. The flood-frequency curve (fig. 4) for site 1 was computed by fitting the logarithms of annual peaks to a Pearson Type III distribution (Water Resources Council, 1967 and 1981). The curve was adjusted to give weight to flood-frequency values calculated with regional regression equations derived for streams in Tennessee (Randolph and Gamble, 1976). An estimated magnitude of the 100-year flood discharge was computed for sites 2 through 8 and for each of the miscellaneous sites using the regional regression equations in the report by Randolph and Gamble (1976). The flood-frequency curve (fig. 5) for site 9 was computed from regional regression equations derived for small urban streams in Tennessee (Robbins, 1984).

Flood Height and Discharge The height of a flood is usually given above a selected datum plane. This datum plane can be arbitrary or it can be a nationally recognized datum such as elevation above National Geodetic Vertical Datum (NGVD). For this report, flood heights at gaging stations and miscellaneous sites are reported as height above NGVD on figure 1. In table 2, flood heights at the gaging stations are reported as gage height above the datum of the gage. The peak gage height plus the datum of the gage equals the height of the peak above NGVD.

The rate of discharge of a stream is the volume of water that passes a particular location in a specific period of time, generally expressed in cubic feet per second. The discharge rates at selected sites for the September 12-13, 1982 flood represent the peak discharge, which generally occurs at the maximum gage height or elevation of the flood. Peak discharges and maximum gage heights for gaging stations and miscellaneous sites are shown in figure 1 and listed in table 2. The discharge hydrographs for Beaver Creek at Huntingdon, a natural basis (site 1, table 2), and Middle Fork Forked Deer River Tributary at Humboldt, an urban basin (site 9, table 2), are shown in figures 6 and 7, respectively. A comparison of figures 6 and 7 shows the difference in timing of the flood peaks and the difference in the length of flooding associated with natural and urban basin conditions.

Peak unit discharge, which is expressed in cubic feet per second per square mile, is generally an indication of flood intensity. During the September 12-13, 1982 flood, the peak unit discharge at the selected gaging stations and miscellaneous sites ranged from 20 (ft³/s)/mi² for South Fork Obion River near Greenfield (site 3, table 2) to 1,400 (ft³/s)/mi² for Cain Creek Tributary near Trenton (site 5, table 2) (fig. 1).

Typical flooding in residential and business areas of Trenton from the September 12-13, 1982 flood are shown in figures 8 and 9. Aerial photographs of some of the areas inundated by the flood were taken by the Tennessee Department of Transportation. Approximate flood boundaries along parts of North Fork Forked Deer River and Rutherford Fork Obion River are shown in figures 10, 11, and 12.

EXTENT OF FLOODING

Flood Damage Three people in Gibson County lost their lives in the flood of September 12-13, 1982, and damages were extensive. Total damages in Gibson County were reported to be \$15.3 million (Tennessee Emergency Management Agency, oral commun., 1984). Approximately \$11.7 million of that damage amount was to agriculture, \$2.5 million to public service facilities, and \$1.1 million to residential areas in Humboldt, Trenton, and Milan.

CONVERSION FACTORS For readers who may prefer to use the International System of Units (SI) rather than the inch-pound units used herein, the conversion factors are listed below:

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Multiply	Ву	To obtain
cubic foot per second (ft ³ /s)	0.02832	cubic meter per second (m ³ /s)
cubic foot per second per square mile [(ft ³ /s)/mi ²]	0.0109	cubic meter per second per square kilometer [(m³/s)/km²]
nch (in-)	25.4	millimeter (mm)
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
square mile (mi ²)	2.590	square kilometer (km²)

National Geodetic Vertical Datum of 1929 (NGVD of 1929): A geodetic datum derived from a general adjustment of the first-order level nets of both the United States and Canada, formerly called "mean sea level."

REFERENCES CITED

Randolph, W. J., and Gamble, C. R., 1976, Technique for estimating magnitude and Robbins, C. H., 1984, Synthetic flood frequency for small urban streams in Tennessee: U.S. Geological Survey Water-Resources Investigations Report 84-4182, 24 p.

U.S. Department of Commerce, 1961, Rainfall trequency atlas of the United States: U.S. Weather Bureau, Technical Paper no. 40, 115 p.

U.S. Water Resources Council, 1967, A uniform technique for determining flood flow frequencies: Washington, D. C., U.S. Water Resources Council Bulletin no. 15, 15 p. 1981, Guidelines for determining flood flow frequency: Washington, D.C., U.S. Water Resources Council Bulletin no. 17B, 183 p.

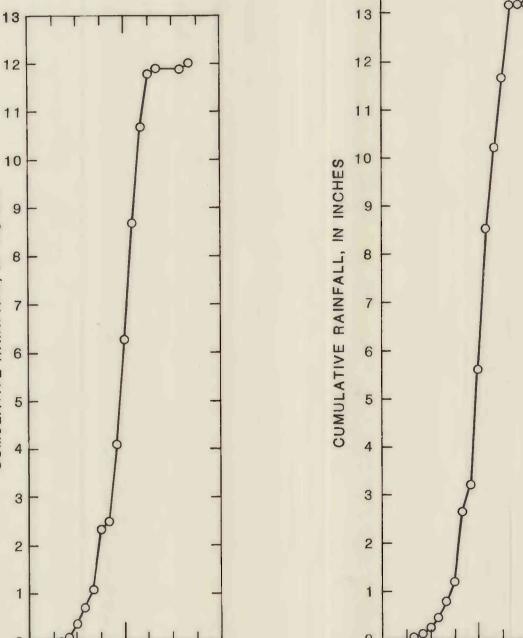


Figure 2.--Mass curve of rainfall at the National Weather Service station at Humboldt, Tenn.

N 3 6 9 M 3 6 9 N

Sept. 12 Sept. 13

1982

TIME, IN HOURS

N 3 6 9 M 3 6 9 N Sept. 12 Sept. 13 1982 TIME, IN HOURS Figure 3.--Mass curve of rainfall at the U.S. Geological Survey urban rainfall-runoff station (site 9) at Humboldt, Tenn. (see table 2 for site description).

Table 2.--Summary of data for the September I2-13, 1982 flood in Gibson, Carroll, and Madison Counties, in West Tennessee [Datum of gage is recorded in feet above National Geodetic Vertical Datum]

Site No.	Station No.	Station name and location	drainage area (mi ³)	100-year flood (ft ³ /s)	of peak	Gage height of peak (ft)	Discharge (ft³/s)	Remarks
1	07024300	Beaver Creek at Huntingdon	55.5	9,590	9/13	15.20	7,290	Datum of gage = 364.20
2	07024370	Little Reedy Creek near Huntingdon.	0.91	924	9/13		971	
3	07024500	South Fork Obion River near Greenfield.	383	27,200	9/16	15.35	7,660	Datum of gage = 300.26
4	07028500	North Fork Forked Deer River at Trenton.	73.5	11,500	9/13	19.62		Datum of gage = 303.41
5	070 28600	Cain Creek Tributary near Trenton.	0.95	947	9/13	12.80	1,330	Datum of gage = 342.51
6	07028700	Cain Creek near Trenton	14.4	4,520	9/13	15.00	15,600	Datum of gage = 311.67
7	07028940	Turkey Creek near Medina	7.87	3,190	9/13	18.43		Datum of gage = 378.11
8	070 289 50	Turkey Creek at Fairview	13.3	4,320	9/13	16.26	14,600	Datum of gage = 355.96
9	07 028985	Middle Fork Forked Deer River Tributary at Humbold	2.12 t.	2,160	9/13	8.29	2,760	Urban runoff project site Datum of gage = 332.61

Contributing Computed Date

0000 8000 7000 8000 Computed discharge 7000 Sept. 12-13, 1982 6000 - flood discharge 10 25 50 100 RECURRENCE INTERVAL, IN YEARS

Figure 4.--Flood-frequency curve for Beaver Creek (site 1) at Huntingdon, Tenn. (see table 2 for site description).

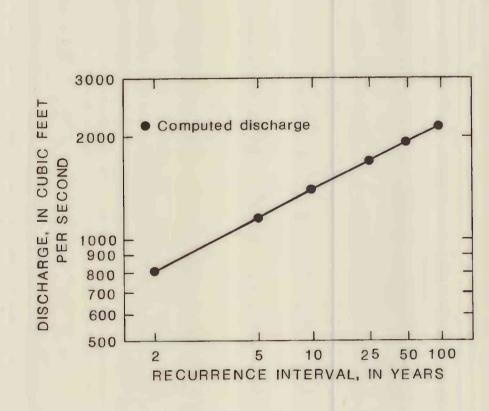


Figure 5 .-- Flood-frequency curve for Middle Fork Forked Deer River Tributary (site 9) at Humboldt, Tenn. (see table 2 for site description).

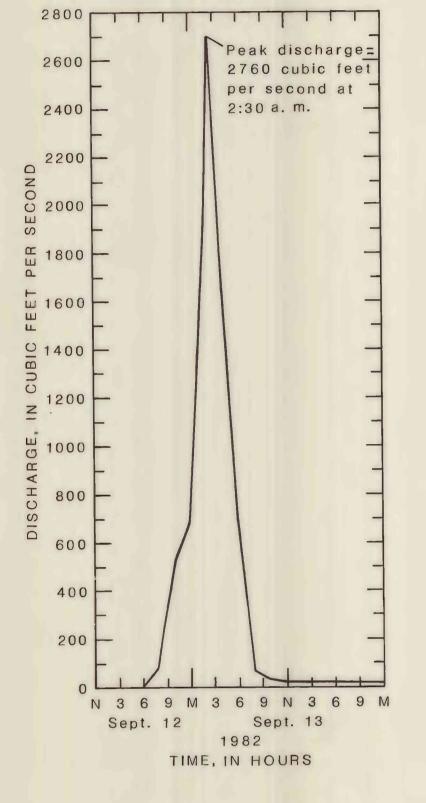


Figure 7.--Discharge hydrograph for Middle Fork Forked Deer River Tributary (site 9) at Humboldt, Tenn. (see table 2 for site description.)



Figure 8.--Flooded residential area in Trenton, Tenn.



Figure 9.--Flooded business area along U.S. Highway 45W in Trenton, Tenn.



of Transportation, 1982 Figure 10.--Approximate flood boundaries of North Fork Forked Deer River along U.S.

Highway 45W Bypass and State Route 77 at Trenton, Tenn.



Figure 11.--Approximate flood boundaries of Rutherford Fork Obion River along U.S.

Highway 70A & 79 between Milan and Atwood, Tenn.

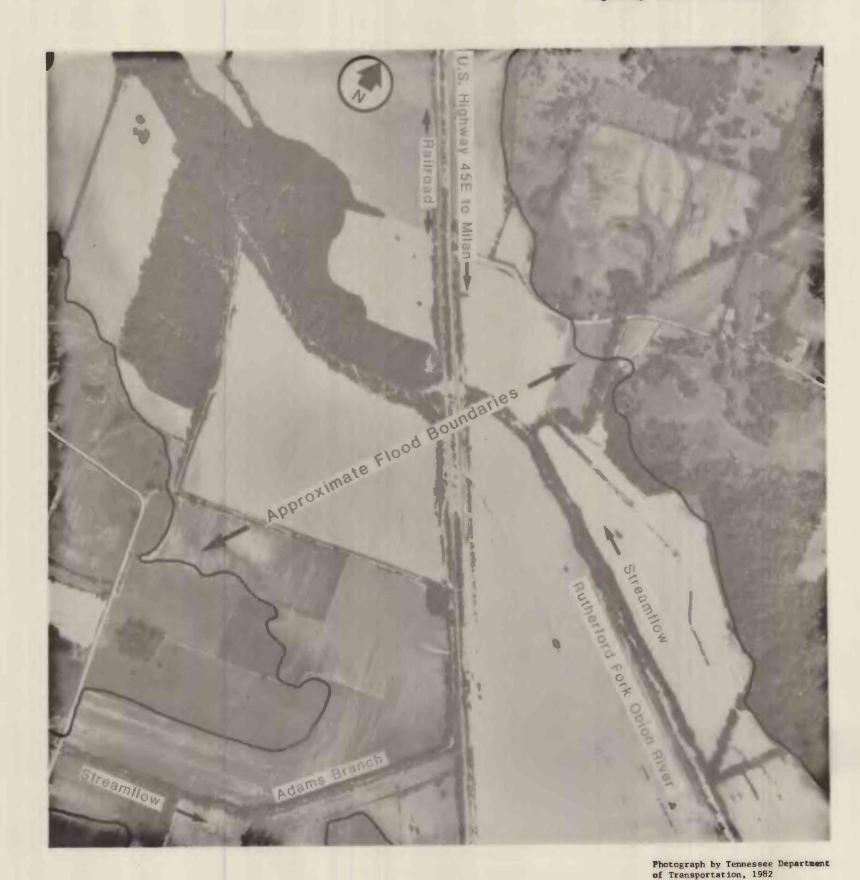


Figure 12.--Approximate flood boundaries of Rutherford Fork Obion River along U.S.

Highway 45E between Milan and Bradford, Tenn.